

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 11-249152

(43)Date of publication of application : 17.09.1999

(51)Int.Cl.

G02F 1/1339

J1033 U.S. PRO

09/021174



(21)Application number : 10-050473

(71)Applicant : MATSUSHITA ELECTRIC IND CO LTD

(22)Date of filing : 03.03.1998

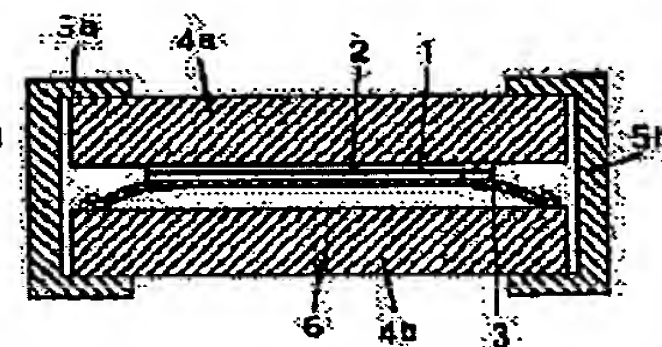
(72)Inventor : SHIDA RYOICHI
YAMAMOTO YOSHITAKA
NISHINO MASAHIRO

(54) MANUFACTURE OF LIQUID CRYSTAL PANEL

(57)Abstract:

PROBLEM TO BE SOLVED: To supply a liquid crystal display(LCD) panel with which the uniformity of a gap is improved, color non-uniformity is eliminated and contrast is improved by preventing the deviation of positions between the TFT substrate and CF substrate of the LCD panel.

SOLUTION: A TFT substrate 1 and a CF substrate 2 are opposed through a sealing agent or spacer, exactly aligned, stuck, uniformly pressed later through vacuum packing, held between fixed panels 4a and 4b before the setting of the said sealing agent and pressed by expanding a rubber plate 3 fixing the surrounding on the surface plate 4b in the shape of frame by feeding air from an air supplying port 6 while keeping constant the distance between these substrates through clamps 5a and 5b. Thus, the warp of the substrate can be removed and the reduction in the aligning accuracy of the TFT substrate 1 and the CF substrate 2 is prevented so that display definition can be improved.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the
examiner's decision of rejection or application
converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of
rejection][Date of requesting appeal against examiner's
decision of rejection]

[Date of extinction of right]

Copyright (C); 1998,2000 Japanese Patent Office

(19)日本国特許庁(JP)

(12)公開特許公報 (A)

(11)特許出願公開番号

特開平 1 1 - 2 4 9 1 5 2

(43)公開日 平成11年(1999)9月17日

(51)Int. Cl.⁶

G 0 2 F

1/1339

識別記号

5 0 5

F I

G 0 2 F

1/1339

5 0 5

審査請求 未請求 請求項の数5

O L

(全4頁)

(21)出願番号 特願平10-50473

(22)出願日 平成10年(1998)3月3日

(71)出願人 000005821

松下電器産業株式会社

大阪府門真市大字門真1006番地

(72)発明者 志田 良一

大阪府門真市大字門真1006番地 松下電器
産業株式会社内

(72)発明者 山本 喜孝

大阪府門真市大字門真1006番地 松下電器
産業株式会社内

(72)発明者 西野 正弘

大阪府門真市大字門真1006番地 松下電器
産業株式会社内

(74)代理人 弁理士 滝本 智之 (外1名)

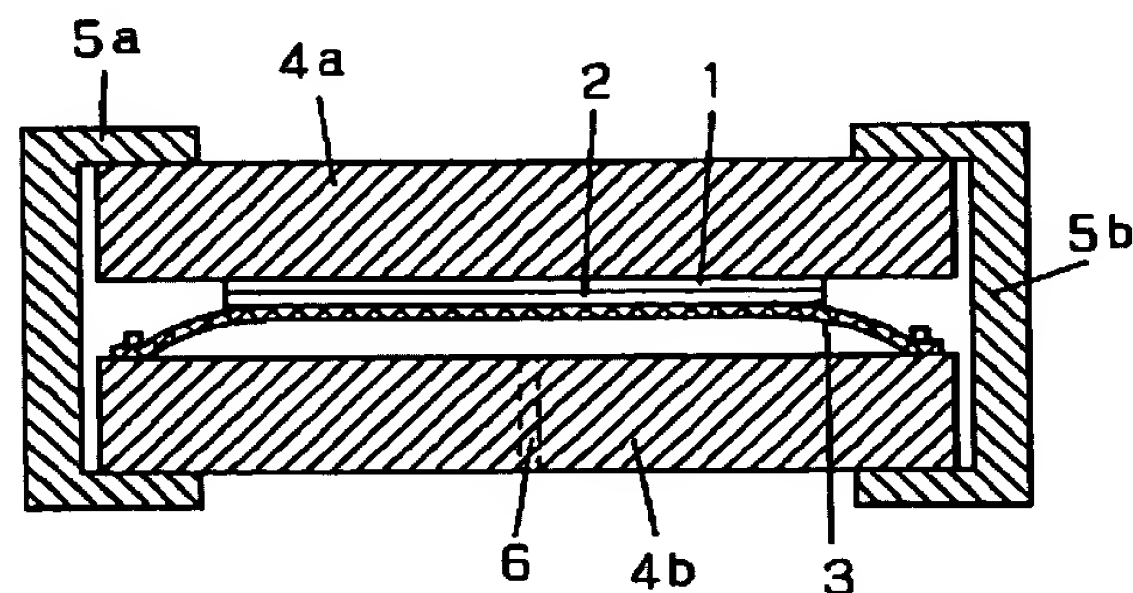
(54)【発明の名称】液晶パネルの製造方法

(57)【要約】

【課題】 液晶パネルのTFT基板とCF基板間の位置ズレを防止し、ギャップの均一性に優れ、色ムラのないコントラストに優れた液晶表示パネルを供給する。

【解決手段】 TFT基板1とCF基板2をシール剤、スペーサーを介して対向せしめ、正確に位置合わせし貼り合わせを行った後、真空バック法により均一に加圧し、該シール剤の硬化前に、定盤4a・4bに挟み込み、クランプ5a・5bでその距離を一定に保ちつつ、周囲を額縁状に定盤4bに固定したゴム板3をエア供給口6よりエアを送り込み膨らませることにより基板を加圧する。この構成により、基板の反りを取り除くことができ、TFT基板1とCF基板2の位置合わせ精度の低下を防止することによる表示品位の向上が実現できる。

1 TFT基板
2 CF基板
3 ゴム板
4a, 4b 定盤
5a, 5b クランプ
6 エア供給口



【特許請求の範囲】

【請求項1】TFT基板とCF基板をシール剤、スペーサーを介して対向せしめ、位置合わせし貼合わせを行った後、真空バック法によって均一に加圧する液晶パネルの製造方法において、該シール剤の硬化前にゴム板の周囲を額縁状に固定した下定盤と、一定距離を保った上定盤の間に基板を挟み込み、下定盤とゴム板の間に一定圧のエアを送り込み、ゴム板を膨らまし基板を下面から加圧することを特徴とする、液晶パネルの製造方法。

【請求項2】真空バック後、シール剤の硬化前に基板を定盤上に上下反転し載置し、上面から一定圧でローラー掛けをし加圧することを特徴とする請求項1記載の液晶パネルの製造方法（流体によって圧力をかけられた膜によってパネルを加圧する）。

【請求項3】流体によって圧力をかけられた膜によってパネルを加圧することを特徴とする、液晶パネルの製造方法（膜はゴム板からなる）。

【請求項4】流体によって圧力をかけられたゴムからなる膜によってパネルを加圧することを特徴とする、液晶パネルの製造方法（流体は一定圧のエアからなる）。

【請求項5】一定圧のエアによって圧力をかけられた膜によってパネルを加圧することを特徴とする、液晶パネルの製造方法。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は液晶を用いた表示パネルに関するものであり、特にTFT基板とCF基板の位置ズレを防止し、品質の優れた液晶表示パネルを供給することにある。

【0002】

【従来の技術】液晶パネルの製造方法としては、ガラス基板上にトランジスタ素子がマトリクス状に配置されたTFT基板1と、ブラックマトリクス及びR、G、B画素がマトリクス状に配置されたCF基板2に、ポリイミドよりなる配向剤をフレキシソ印刷法等により形成した後、ラビング処理等により配向処理を施す。

【0003】つぎにTFTまたは、CF基板の一方にエポキシ樹脂等よりなるシール剤をスクリーン印刷法により、リング状に設けた後、球状のスペーサーを均一に複数個配置する。

【0004】このTFT基板1とCF基板2を上下対向するように位置合わせ装置上に配置し、位置合わせを行った後加圧、貼合わせを行う。

【0005】ついで、位置合わせ装置から取り出し、均一に加圧しつつ、150℃に保たれた、オーブンに1時間程度放置し、シール剤の硬化及び所定ギャップを形成した後液晶を注入し、注入口を封止しパネルを得ていた。

【0006】

【発明が解決しようとする課題】このような製造方法に

において、TFT基板1とCF基板2を正確に位置合わせした後、位置合わせの精度を確保しつつ、シール剤を加熱し硬化せしめるのであるが、搬送中にTFT基板1とCF基板2に自重により反りが生じる。

【0007】この基板の反りにより、TFT基板1とCF基板2のトータルピッチに差異が生じ、TFT基板1とCF基板2の位置合わせ精度が悪くなり、コントラスト、ギャップ精度の低下を引き起こし、表示品質が劣るという問題点があった。

【0008】またこのような問題点を解決するために、紫外線硬化型樹脂を使用し、TFT基板とCF基板を仮固定する方法が考えられている。しかしこの方法も、仮止め接着剤はパネル端部、すなわち有効画素外に塗布される為、基板の反りを防止できず、トータルピッチの差異によって生ずる有効画面内の位置精度の低下に対しては、有効ではなかった。

【0009】また、シール剤として、紫外線硬化型の樹脂を使用する事も考案されているが、基板との接着性、液晶への影響を考慮し、紫外線、熱硬化併用型であるため、硬化時の熱の影響は避けられないものであり、自重による基板の反りの防止に対しても、有効なものとは言えなかった。

【0010】

【課題を解決するための手段】以上の問題を解決するため、本発明の液晶パネル製造方法は、TFT基板とCF基板を正確に位置合わせし貼合わせを行い、真空バック法によって均一に加圧した後、ゴム板の周囲を額縁状に固定した下定盤と、一定距離を保った上定盤の間に挟み込み、下定盤とゴム板の間に一定圧のエアを送り込み、ゴム板を膨らまし基板を下面から加圧する構成あるいは、真空バック法によって均一に加圧した後、基板を上下反転させ、定盤上に載置し上面から一定圧でローラー掛けをし加圧する構成を有したものである。

【0011】この構成によって、TFT基板1とCF基板2を正確に位置合わせし貼り合わせた後、シール剤が硬化されるまでに、搬送中に基板の自重によって生ずる基板の反りを取り除くことができ、TFT基板1とCF基板2のトータルピッチの差異の発生を抑え、位置合わせ精度の低下を防止し、有効画素部のギャップを均一に形成し、コントラスト等に優れた、品質の優れた液晶パネルを供給することができる。

【0012】

【発明の実施の形態】以下、本発明の実施の形態を示す。

【0013】（本発明の実施の形態1）ガラス基板上にトランジスタ素子がマトリクス状に配置されたTFT基板1と、ブラックマトリクス及びR、G、B画素がマトリクス状に配置されたCF基板2に、ポリアミク酸のN-メチル2ピロリドン溶液を厚さ800オングストロームになるようにフレキシソ印刷法より形成した。この

基板を190℃90分加熱しポリイミドの皮膜を得た後、レーヨン製の布にて配向処理を行った。この基板にエポキシ樹脂よりなるシール剤をスクリーン印刷法により形成し、平均粒子径5 μ mのガラススペーサーを100個/mm²の密度で分散した。この基板にデイスペンサーにてUV仮止め接着剤を4箇所塗布した。

【0014】しかる後、TF T基板1とCF基板2が対向するよう、位置合わせ装置に取付、正確に位置合わせした後0.3kg/cm²の力で加圧しつつ紫外線を500mj/cm²の光量で照射し、仮止め接着剤を硬化せしめた。この基板を真空バック法により均一に加圧しつつ、定盤4a・4bに挟み込み、クランプ5a・5bでその距離を一定に保ちつつ、周囲を額縁状に定盤4bに固定せしめたゴム板3と定盤4bとの間隙にエア供給口6より1.2kg/cm²のエアを送り込み、ゴム板3を膨らませ下面から加圧することにより、自重によるそりを取り除いた後に、150℃60分間加熱し、シール剤を硬化せしめ、後液晶を注入し、注入口を封止しパネルを得た。

【0015】このパネルのTF T基板1とCF基板2の位置合わせ精度は、 $\pm 2\mu$ m以内であり、面内ギャップも均一であった。

【0016】この得られたパネルに液晶材料を注入し、注入口を封口した後偏光板を貼付けて得られた液晶パネルは、BM端部より光漏のない、面内ギャップ精度が $\pm 0.2\mu$ mとギャップ精度の高い、コントラスト低下のない液晶パネルであった。

【0017】(本発明の実施の形態2) 本発明の実施の形態1と同様にして、貼り合わせの完了したパネルを真空バック法により均一に加圧しつつ、上下反転し定盤8上に載置し、ローラー7により0.5kg/cm²の力で上面から加圧することにより、自重によるそりを取り除いた後に、150℃60分間加熱し、シール剤を硬化せしめ、後液晶を注入し、注入口を封止しパネルを得た。

【0018】このパネルのTF T基板1とCF基板2の位置合わせ精度は、 $\pm 2\mu$ m以内であり、面内ギャップも均一であった。

【0019】この得られたパネルに液晶材料を注入し、注入口を封口した後偏光板を貼付けて得られた液晶パネルは、BM端部より光漏のない、面内ギャップ精度が $\pm 0.2\mu$ mとギャップ精度の高い、コントラスト低下のない液晶パネルであった。

【0020】(比較例) 実施例と同様にして、貼り合わせの完了したパネルを真空バック法により均一に加圧しつつ、150℃60分間加熱し、シール剤を硬化せし

め、後液晶を注入し、注入口を封止しパネルを得た。

【0021】このパネルのTF T基板1とCF基板2の位置合わせ精度は、パネルの自重によるパネルの反りにより $\pm 10\mu$ m以上であった。

【0022】この得られたパネルに液晶材料を注入し、注入口を封口した後偏光板を貼付けて得られた液晶パネルは、BM端部より光漏れを生じ、面内ギャップ精度が $\pm 0.6\mu$ mとギャップ精度の低い、コントラストの低下した液晶パネルであった。

【0023】(なお書き) なお、本願の実施の形態では、圧力をかける方法として、周囲を下定盤に額縁状に固定したゴム板と下定盤の間に一定圧のエアを送り込む方法、ローラー掛けをする方法を示したが、これらの方法に限らず、一定に圧力をかけることが出来ればよい。

【0024】たとえば、膜(ゴム、ビニール等)を介して流体(水、油、空気等)から圧力をかけるようにしても良い。

【0025】

【発明の効果】本発明によれば、位置合わせを正確に行った後、シール剤が硬化されるまでに、TF T基板とCF基板の自重による基板の反りを取り除く事ができ、TF T基板とCF基板のトータルピッチの差異の発生を抑え、位置ズレを生じる事なく、有効画素部のギャップを均一に形成することが可能となり、シール剤の硬化時の収縮、基板の反りや熱膨張による応力等の影響も緩和し、さらに位置合わせ精度の高いパネルの製造が可能であり、色むら等の問題の無い、またコントラストの低下のない液晶パネルを供給することができる。

【図面の簡単な説明】

【図1】本発明の真空バック工程後の風船加圧構成図

【図2】本発明の真空バック工程後のローラー加圧構成図

【図3】自重による反りを生じトータルピッチ差を生じた基板の説明図

【符号の説明】

1 TF T基板

2 CF基板

3 ゴム板

4a, 4b 定盤

5a, 5b クランプ

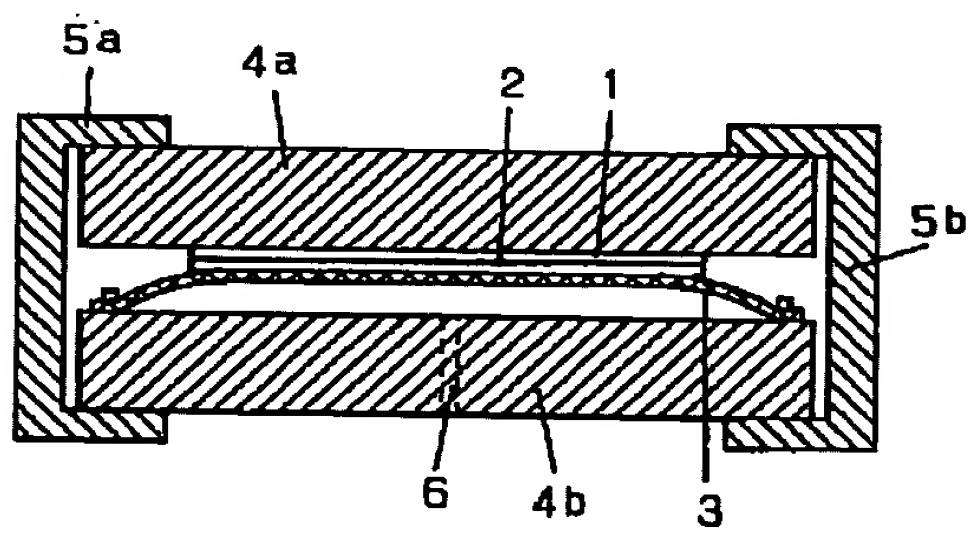
6 エア供給口

7 ローラー

8 定盤

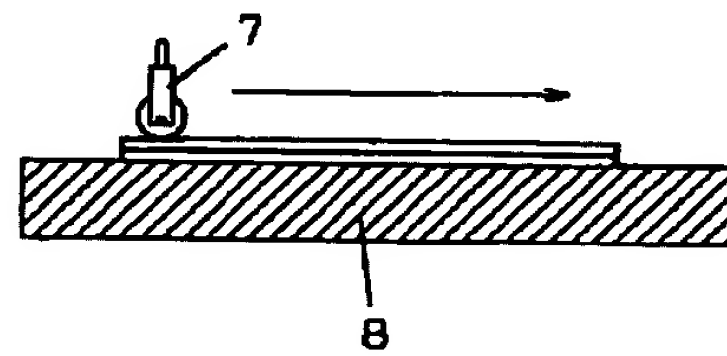
【図1】

- 1 TFT基板
- 2 CF基板
- 3 ゴム板
- 4a, 4b 定盤
- 5a, 5b クランプ
- 6 エア供給口



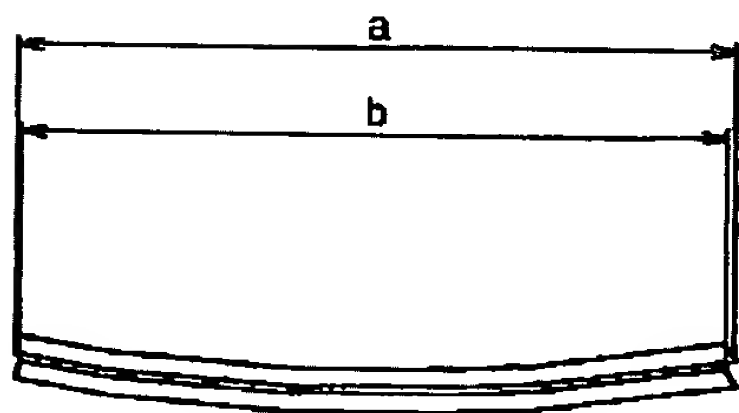
【図2】

- 7 ローラー
- 8 定盤



【図3】

- a CF基板の
トータルピッチ
- b TFT基板
のトータルピッチ
- a-b トータルピッチ差



ENTITLED "MANUFACTURE OF LIQUID CRYSTAL PANEL"

From Page 2, Column 1, Line 1

To Page 3, Column 4, Line 44

[What is Claimed is:]

[Claim 1] A manufacture of a liquid crystal panel in which a TFT substrate and a CF substrate are opposed via a sealing agent and spacer, exactly aligned, stuck, and uniformly pressed through vacuum packing, the manufacture of a liquid crystal panel being characterized in that, before curing the sealing agent, the substrates are held between a lower fixed panel on which the periphery of a rubber plate is fixed in the shape of a picture frame and an upper fixed panel maintaining a uniform distance therefrom, and air of uniform pressure is supplied between the lower fixed panel and the rubber plate to expand the rubber plate and press the substrates from the lower surface.

[Claim 2] The manufacture of a liquid crystal panel as claimed in claim 1, wherein, after vacuum packing, the substrates are turned upside down, placed on the fixed panel, and uniformly pressed with a roller from the upper surface, before the sealing agent is cured. (The panel is pressed

with a film which is pressed by fluid.)

[Claim 3] The manufacture of a liquid crystal panel, wherein the panel is pressed with a film which is pressed by fluid. (The film is made of a rubber plate.)

[Claim 4] The manufacture of a liquid crystal panel, wherein the panel is pressed with a film which is made of rubber and pressed by fluid. (The fluid is air of uniform pressure.)

[Claim 5] The manufacture of a liquid crystal panel, wherein the panel is pressed with a film which is pressed by air of uniform pressure.

[Detailed Description of the Invention]

[0001]

[Field of the Invention]

The present invention relates to a display panel using liquid crystal, and particularly prevents the deviation of positions between a TFT substrate and a CF substrate to supply a liquid crystal display panel of excellent quality.

[0002]

[Prior Arts]

A liquid crystal panel is manufactured with such a method wherein an alignment agent made of polyimide is produced through the flexographic printing method or the like on a TFT substrate 1, in which transistor elements are arranged on a glass substrate in the state of a matrix, and on a CF substrate 2, in which a black matrix and R, G and B

image pixels are arranged in the state of a matrix, and then the alignment treatment is performed through the rubbing treatment.

[0003]

Then, a sealing agent made of epoxy resin and the like is provided in the shape of a ring on either one of the TFT substrate and the CF substrate through the screen printing method, and a plurality of spherical spacers are arranged uniformly thereafter.

[0004]

The TFT substrate 1 and the CF substrate 2 are arranged on an aligning device so as to oppose each other vertically to be pressed and stuck after alignment.

[0005]

Then, they are taken out of the aligning device, and while pressed uniformly, they are left in an oven kept at 150°C for about one hour. After the cure of the sealing agent and formation of a predetermined gap, liquid crystal is injected and an injection port is sealed to obtain a panel.

[0006]

[Subjects To Be Solved By the Invention]

In this manufacturing method, after exactly aligning the TFT substrate 1 and the CF substrate 2, the seal agent is heated and cured with maintaining the accuracy of the alignment. However, warp occurs in the TFT substrate 1 and the CF substrate 2 during transportation due to their

deadweight.

[0007]

Difference of the total pitches between the TFT substrate 1 and the CF substrate 2 is caused due to the warp of the substrates, and thus the aligning accuracy of the TFT substrate 1 and the CF substrate 2 is deteriorated, and the contrast accuracy and the gap accuracy are also deteriorated, thereby the display quality is deteriorated.

[0008]

To solve such problems, the method is considered that the TFT substrate and the CF substrate are temporarily fixed using an ultraviolet curing resin. However, since the temporarily fixing adhesive is applied to the end part of the panel, that is, the outside of the effective image pixels in this method, the warp of the substrates could not be prevented and this method was ineffective to the deterioration of the positional accuracy in the effective screen caused by the difference of the total pitches.

[0009]

Though use of an ultraviolet curing resin as the sealing agent is also devised, this resin is both ultraviolet curing type and heat curing type considering the adherence with respect to the substrates and the influence to the liquid crystal, and thus the influence of heat in curing cannot be avoided. This method was also ineffective to the prevention of the warp of the substrates due to their

deadweight.

[0010]

[Means for Solving the Subjects]

To solve the aforesaid problems, the manufacture of a liquid crystal panel of the present invention has the constitution that a TFT substrate and a CF substrate are exactly aligned, stuck, uniformly pressed through vacuum packing, and then held between a lower fixed panel onto which the periphery of a rubber plate is fixed in the shape of a picture frame and an upper fixed panel maintaining a uniform distance therefrom, to expand the rubber plate by feeding air between the lower fixed panel and the rubber plate so as to press the substrates from the lower surface. Or, the manufacture of a liquid crystal panel has the constitution that, after uniformly pressed through vacuum packing, the substrates are turned upside down and placed on a fixed panel to be pressed uniformly with a roller from the upper surface.

[0011]

With such constitutions, the warp of the substrates is able to be removed, which is caused by their deadweight during transportation after exactly aligning and sticking the TFT substrate 1 and the CF substrate 2 and before the cure of the seal agent. Further, the difference of the total pitches between the TFT substrate 1 and the CF substrate 2 is prevented, the deterioration of the aligning accuracy is prevented, and the gap in the effective image pixel part is

formed uniformly, thereby a liquid crystal panel of excellent contrast and high quality is able to be supplied.

[0012]

[Preferred Embodiments of the Invention]

Embodiments of the present invention are shown below.

[0013]

(Embodiment 1 of the present invention)

Polyamic acid N-methyl-2-pyrrolidone solution was formed 800 angstrom in thickness through the flexographic printing method on a TFT substrate 1, in which transistor elements were arranged in a matrix on a glass substrate, and a CF substrate 2 in which a black matrix and R, G and B pixels were arranged in a matrix. These substrates were heated at 190 °C for 90 minutes to obtain a polyimide skim, and then the alignment treatment was performed with a rayon cloth. A sealing agent made of epoxy resin was formed on the substrates through the screen printing method and glass spacers of 5 μ m in average diameter were dispersed in the density of 100/mm². UV temporarily fixing adhesives were applied in four places on these substrates by a dispenser..

[0014]

Then, the TFT substrate 1 and the CF substrate 2 were opposed, mounted on an aligning device, and exactly aligned, and then the temporarily fixing adhesive was cured by pressing the substrates with the power of 0.3 kg/cm² and at

the same time by irradiating the substrates with the ultraviolet of 500 mj/cm². These substrates were held between the fixed panels 4a and 4b with uniformly pressed through vacuum packing. Air of 1.2 kg/cm² was supplied from an air supplying port 6 to the gap between the fixed panel 4b and a rubber plate 3 which is fixed its periphery on the fixed panel 4b in the shape of a picture frame with maintaining the distance between the substrates uniform by clamps 5a and 5b, and the rubber plate 3 was expanded to press the substrates from the lower surface, thereby the warp due to their deadweight was removed. Then, the substrates were heated at 150 °C for 60 minutes to cure the sealing agent, liquid crystal was injected, and the injection port was sealed to obtain the panel.

[0015]

The aligning accuracy between the TFT substrate 1 and the CF substrate 2 of this panel was within $\pm 2\text{mm}$, and the in-surface gap was also uniform.

[0016]

The liquid crystal panel, which was obtained by injecting the liquid crystal material to the panel obtained as described above, sealing the injection port and sticking a polarizing plate, caused no leak of light from the BM end portion, had the excellent gap accuracy such as the in-surface gap accuracy of $\pm 0.2 \mu\text{m}$ and had no deterioration of

contrast.

[0017]

(Embodiment 2 of the present invention)

In the same way as the Embodiment 1 of the present invention, the stuck panel was turned upside down and placed on a fixed panel 8 with uniformly pressed through vacuum packing, and was pressed from the upper surface by a roller 7 with the power of 0.5 Kg/cm^2 , so as to remove the warp due to its deadweight. Then, the panel was heated at 150°C for 60 minutes to cure the sealing agent, and then liquid crystal was injected and the injection port was sealed to obtain the panel.

[0018]

The aligning accuracy between the TFT substrate and the CF substrate of this panel was within $\pm 2 \text{ }\mu\text{m}$, and the in-surface gap was also uniform.

[0019]

The liquid crystal panel, which was obtained by injecting the liquid crystal material to the panel obtained as described above, sealing the injection port and sticking a polarizing plate, causes no leak of light from the BM end portion, had the excellent gap accuracy such as the in-surface gap accuracy of $\pm 0.2 \text{ }\mu\text{m}$ and had no deterioration of contrast.

[0020]

(Comparative Example)

In the same way as the embodiments, the stuck panel was heated at 150 °C for 60 minutes with uniformly pressed through vacuum packing to cure the sealing agent, liquid crystal was injected and the injection port was sealed to obtain the panel.

[0021]

The aligning accuracy between the TFT substrate and the CF substrate of this panel was $\pm 10 \mu\text{m}$ or more because of the warp of the panel due to its deadweight.

[0022]

The liquid crystal panel, which was obtained by injecting the liquid crystal material to the panel obtained as described above, sealing the injection port and sticking a polarizing plate, caused leak of light from the BM end portion, had the low gap accuracy such as the in-surface gap accuracy of $\pm 0.6 \mu\text{m}$ and had deteriorated contrast.

[0023]

(Notes)

In the embodiments of the present invention, the method of supplying air of uniform pressure between the lower fixed panel and the rubber plate, which is fixed its periphery on the lower fixed panel in the shape of a picture frame, as well as the method of pressing with a roller are shown as the pressing method. However, the present invention is not

limited thereto, and any methods are applicable as far as capable of uniformly pressing.

[0024]

For example, pressure may be applied by fluid (water, oil, air and the like) through a film (rubber, vinyl and the like).

[0025]

[Effects of the Invention]

In the present invention, the warp of the TFT substrate and the CF substrate due to their deadweight is able to be removed before the sealing agent is cured after exactly aligning them, the difference of the total pitches between the TFT substrate and the CF substrate is prevented, the deviation of positions is never caused, and the gap in the effective image pixel part is able to be formed uniformly. Further, the influence of the shrinkage of the seal agent in curing as well as the influence of the stress due to the warp of the substrates and thermal expansion are reduced. Accordingly, a panel of excellent aligning accuracy is able to be produced, and a liquid crystal panel including no problem such as non-uniformity of color and having no deterioration of contrast is able to be supplied.

[Brief Description of the Drawings]

[Fig. 1] A constitutional view of balloon pressure of the present invention after the vacuum packing step

[Fig. 2] A constitutional view of roller pressure of the

present invention after the vacuum packing step

[Fig. 3] An illustration showing the substrates having warp due to their deadweight and caused the difference of total pitches

[Description of the References]

- 1 TFT substrate
- 2 CF substrate
- 3 Rubber plate
- 4a and 4b Fixed panels
- 5a and 5b Clamps
- 6 Air supplying port
- 7 Roller
- 8 Fixed panel